METHODS OF TRAINING: SEQUENCING OF PROGRAMMING AND ORGANIZING TRAINING

CURRICULUM

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Introduction

The foundation of contemporary athletic training was created many decades ago when knowledge of training was incomplete and the levels of workloads, results, and demands were lower than they are today. At that time, traditional periodization, meaning a division of the entire seasonal program into smaller periods was proposed. The traditional periodization training plan was repeated many times and became the most widely used approach to training athletes. However, further progress in athletics showed contradictions between traditional periodization and successful training means used by other prominent coaches and athletes. As these methods became more widely accepted they led to alternative training styles, and ultimately became a new training approach known as block periodization (Yessis & Trubo, 1987).

In the former Union of Soviet Socialist Republics, a distinctive method of developing the strength of a nation through its people was created. Winning competitions were a reflection on the country, not on a particular individual or team. However, the fall of the Union in 1991 foreshadowed the end of their reign of athleticism. Prior to this, their hold on athletic supremacy was undeniable and can best be explained by the following comparison. At the 1984 Summer Olympic Games in Los Angeles, in which the USSR and its Eastern Bloc allies boycotted, the American athletes captured 174 total medals. A few weeks later, the boycotting countries staged the 1984 Friendship Games in Moscow and the following results were humiliatingly noteworthy. In track and field, of the forty-one gold medals in Los Angeles, twenty-eight of those final results were surpassed at the friendship games. In addition, in the swimming competition, five world

records and a total of forty swimmers exceeded the time of their American competitors. The difference was a superior method of training. Training methods such as the conjugate method and block training model were used with so much success that results previously mentioned were routine (Siff & Verkhosansky, 1999; Yessis & Trubo, 1987).

Since the fall of the Soviet empire, America has risen to the top of international sporting competitions. It has become the belief of many of America's coaches that their exceptional training programs have become the reason for this new dominance in sport. When the U.S., or any athlete from any country, succeeds in international competition criteria such as genetics, sport selection, and motivation or determination become as important as the training program itself. The U.S. has one of the, if not the, most powerful economies in the world, with nearly unlimited resources, and arguably the most diverse population in the world from which come genetically gifted athletes by the plethora. Charlie Francis, a former world-class 100m sprinter and Olympic caliber coach had this to say about the effects of soviet training methods on American athletes:

> The US has an ocean of talent and a colossally low success rate that still provides more athletes in track than the rest of the world combined. I venture to say that if those good coaches over there had control of the majority of the great talent here, the results would be frightening to think about. (Siff & Verkhosansky, 1999, p.225)

Purpose Statement

The positive outcomes of strength and conditioning programs cannot continue forever; eventually physical adaptations will occur less frequently and performance plateaus will be experienced. When this occurs there will be an increased chance for the athlete to become over-trained or experience injury. Variations in training, which include modifications to volume, load, and intensity, must be made to continue performance improvements and limit injuries throughout the training cycle. This strategy is called periodization (Garhammer, 1979; Stone & O'Bryant, 1987; Stone, O'Bryant, & Garhammer, 1981; Stone, O'Bryant, Garhammer, McMillian, & Rozenek, 1982).

This project will look at the different methods and models of periodization used for training athletes, as well as discuss the efficiency and effectiveness of each model as it pertains to sports training in an attempt to find the most optimal method for training athletes. Specifically, comparisons will be made between the American style of training and those of the former Soviet Republic that were used to dominate sport competitions for two decades. The project will culminate in a proposed curriculum for a training program based on the results of the literature review.

The majority of the research used for this project came from authors who write for the National Strength and Conditioning Association (NSCA, which represents the United States), and from former coaches of eastern bloc countries. Training methods in America have changed very little in the past few decades and research that is done is focused on comparisons within the traditional training model that is used in the America. While literature and texts that lay the foundation for the block model of periodization tend to

date back several decades, their methods and practices have yet to be implemented in the United States. Therefore, the concepts and benefits of block periodization which have been around for many years have yet to be realized in the United States.

Western Training Theory (Linear) Traditional Periodization

Russian physiologist Leo Matveyev proposed the concept of periodization. His work was translated and modified by American scientists with application to strength training and power athletes (Matveyev, 1966). The most commonly used method of periodization in the U.S. is linear periodization, which was developed based off Matveyev's work.

In this model the overall training program is broken down into specific time periods. The largest period is the macrocycle, which usually consists of an entire year, but can also be a period of months to years (up to 4 years for Olympic athletes). Within the macrocycle is the mesocycle, which can last several weeks to months. Mesocycles are divided into even smaller periods call microcycles. These are typically 1-4 weeks long. The length of each cycle is dependent on the athlete's training goals and the number of competitions that are present within the given training period (Chargina et al., 1986; Chargina et al., 1987a; Stone & O'Bryant, 1987; Stone et al., 1982).

Within each training cycle volume and intensity are manipulated the most, and are directly related to the amount athletic skill related work that the athlete is performing. Sport training requires that athletes practice those skills, and the time dedicated to acquiring sport skill must be accounted for in the strength and conditioning program. The amount of time dedicated to skill practice is relative to the competition schedule. This is the structure and reasoning behind linear periodization. The linear model involves

shifting training priorities from non-sport specific activities of high volume and lower intensity to sport specific activities of low volume and higher intensity over a period of time to prevent overtraining and maximize performance (Matveyev, 1966).

There are several major divisions within the linear model. Those divisions are the preparatory, competition, and transition periods (Stone et al., 1981). Specifically, the model consists of the preparatory period, followed by the first transition. This is followed by the competition period, and then the second transition. As illustrated in Figure (1), intensity begins lower and increases gradually, and volume starts higher, and slowly decreases as the athlete's conditioning level increases (Matveyev, 1966; Stone et al., 1981; Tchiene, 1979). Table 1 summarizes the characteristics of each training period of the traditional approach.

Table 1 General Characteristics of the Traditional Approach (Matveyev, 1977)

Period	**Stage**	**Aims**	**Workload**
Preparatory	General preparatory	Raising the level of general motor abilities, increasing the repertory of various motor skills	Relatively high volume and reduced intensity of main exercises, great variety of training means
Preparatory	Special preparatory	Development of a specific training level,	Load volume reaches maximum and

		development of more specialized motor abilities	intensity increases selectively
Competitive	Competitive preparation	Enhancing event specific motor abilities, technical and tactical skills	Stabilization and reduction of volume together with an increase of intensity in event specific exercises
Competitive	Immediate pre-competitive training	Achieving event specific fitness and attaining readiness for the main competition	Low volume, high intensity
Transitional	transitory	recovery	Active rest with the use of various activities

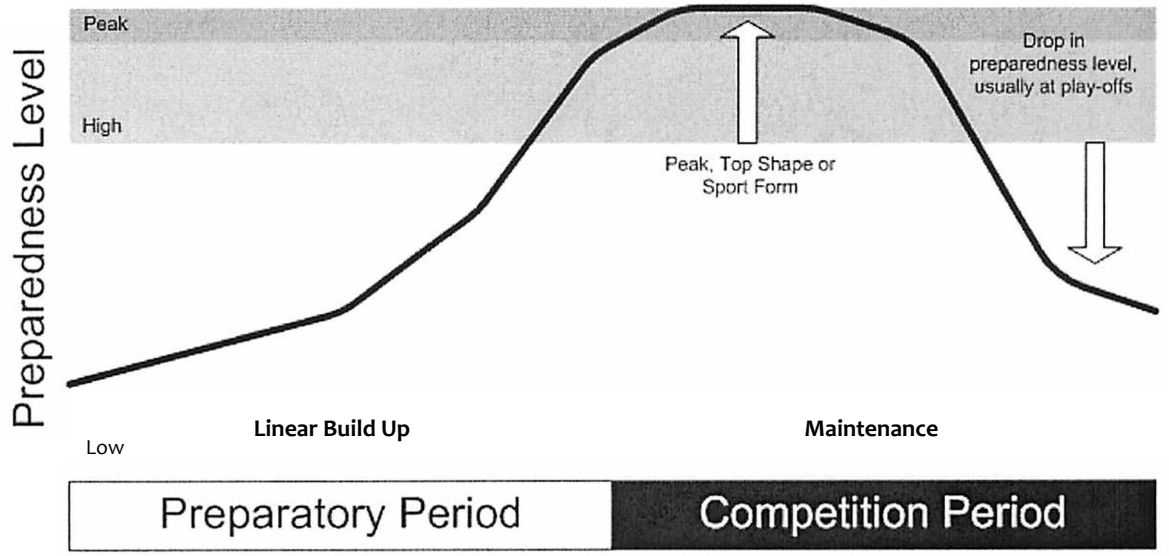

Figure (1): Mateyev's model of periodization (1966)

Preparatory Period

The preparatory period is the initial stage and is generally the longest period. This stage usually occurs at a time of limited sport skill practice and no competitions. Activities during this time are low in intensity and high in volume, with the emphasis being on preparing the athlete for more intense training to come. During this time, the athlete can experience a high level of fatigue due to the high volume of training, so sport-skill technique is not advised. As the preparatory period increases more attention is given to sport-skill technique as the strength training loads increase and training volume decreases (Chargina et al., 1986; Chargina et al., 1987a). Mateyev's model was modified further with the creation of three phases within the preparatory period. They are the endurance and hypertrophy phase, basic strength phase, and the strength and power phase. Each of these phases varies its training volume and intensity (Stone & O'Bryant, 1987; Stone et al., 1982).

Endurance and Hypertrophy Phase

The endurance and hypertrophy phase occurs during the early stages of the preparatory period and may last anywhere from 1-6 weeks (Fleck & Kraemer, 1997) The goals for this phase are to increase lean body mass and develop an endurance base for the more intense training in later phases. Early in this phase, the sport-conditioning activities are not specific to the athletic sport. However, as this phase continues over many weeks, the training becomes more specific to the sport. This phase is usually followed by a recovery week of low intensity, low volume training prior to beginning the next phase (Fleck & Kraemer, 1988).

Strength and Power Phase

Later in the preparatory period, the strength and power phase occurs which aims to increase maximal strength and power in the body. This phase will use movements and exercises that closely resemble the sport in which the athletes compete. The training load and intensity are at their highest during this phase of the preparatory period (Chargina et al., 1986; Chargina et al., 1987a; Chargina et al., 1987b). Following the strength and power phase is the first transition period where there is a break from high volume and high intensity training aimed at allowing maximal recovery before the start of the competition cycle (Chargina et al., 1986; Chargina et al., 1987a; Chargina et al., 1987b).

Competition Period

The primary goal of the competition period is to peak strength and power through increases in training intensity while decreasing training volume. Physical conditioning decreases during this period to allow for a dramatic increase in sport practice; this is where sport skills and game strategies will be the primary focus. The competitive period

for most organized sports will last several months at a time. The prolonged time requires that training intensity be manipulated on a weekly basis. Typically an athlete may peak for around 1-3 weeks before overtraining sets in. Typically during those few weeks training is characterized by high intensity and low volume activities. Between the competitive period and the next preparatory period is the second transition period. This period is usually referred to as active rest or restoration, and usually lasts around 4 weeks. Activities during this time are unstructured, non-sport specific, recreational activities performed at low intensities with low volumes. This phase of training usually does not involve strength training and allows times for the athlete to recovery from the competitive season and rehabilitate any possible injuries that may have resulted from the season. (Chargina et al., 1986; Chargina et al., 1987a; Chargina et al., 1987b).

Positives and Negatives of the Traditional Approach

The traditional theory of training athletes was formulated at a time when there was limited knowledge and few scientifically proven guidelines for coaching. Traditional training periodization adopted the up to date knowledge of the 1960's and was a breakthrough for coaching and sports training science. Many of the elements of the program proposed then remain valid to this day, including the terminology of training cycles, the differentiation between general and specialized athletic preparation, changes in exercise volume and intensity, and basic approaches to short-term, medium-term, and long-term planning. It would be unrealistic to expect that all of the ideas proposed more than four decades ago would remain applicable today. Therefore, several of the

principles of athletic preparation are not important in the block training approach (Bompa, 1999).

The traditional approach is still appropriate for low level athletes. It does not work well for high performance athletes. The traditional theory also contains a number of contradictions which dramatically reduce athletic preparation effectiveness. For example, preparatory period training for high level athletes in endurance sports and team sports assumes the development of general aerobic abilities, muscle strength, muscle endurance, improvement in general coordination and explosive ability, treatment of previous injuries, and basic mental and technical preparation. However, many of the workloads are not comparable and create conflicting responses. A maximum strength program requires muscle hypertrophy and enhancement of the neural mechanism of muscular contraction. The extensive endurance workloads capture the metabolic energy that is necessary for anabolism during post-workout recovery. This suppresses muscle hypertrophy. Enhancement of the neural mechanism is of primary importance for improving explosive strength and is conditioned by the state of the central nervous system as well as the sensitivity of the neuro-motor pool. High volume training can cause permanent fatigue, and as a result, the central and peripheral neural factors are far from optimum, which is needed for improvement of the muscular contraction. Developmental programs for maximum and explosive strength and strength endurance should be separate. The problem with high level athletes is that their progress demands large highly concentrated workloads that cannot be simultaneously managed to achieve many different objectives (Bompa, 1999). An additional drawback of the traditional theory is its inability to prepare athletes for successful participation in many

competitions. Even the three-peak annual cycle does not satisfy the international sport trend towards many competitions throughout the year. These factors are summarized in Table 2.

Table 2. The main contradictions of the traditional training theory

Factors	Contradictions	Consequences
Energy supply	There is sufficient energy supply for concurrent performance of diverse workloads	Energy is directed at too many targets while the primary target doesn't receive the appropriate attention
Restoration of different physiological systems	Because of the differing periods for recuperation of different physiological systems, athletes do not get sufficient restoration	Athletes become fatigued and can't concentrate their full effort on the main objectives
Compatibility of various workloads	Different exercises often interact negatively due to energy deficits, technical complexity, and neuromuscular fatigue	Executing certain loads eliminates or reduces the effect of previous or subsequent workloads
Mental concentration	Performing stressful workloads demand high levels of mental concentration that can't be directed at many targets simultaneously	Mental concentration dissipates and exercises are performed with reduced attention and motivation
Training stimulus for progress	Sports-specific progress of high level athletes demands large amounts of training stimuli that can't be obtained by concurrently training for many factors	Complex simultaneous development of many abilities doesn't provide sufficient improvement for high level athletes

The drawbacks to the traditional training concept were a crucial factor in seeking an alternative training approach. The three most notable limitations included:

1.) Restrictions created by the simultaneous development of a number of motor and technical abilities.

2.) The inability to provide multi-peak competition.

3.) Excessively long periods of basic and sport-specific preparation.

The tremendous changes in world sport competition in recent decades are having a strong influence on the evolution of the training process. While the variety and uniqueness of each sport makes it difficult to be specific, these changes can be summarized as follows:

1.) A dramatic increase in the number of competitions and competitive performances.

2.) A remarkable reduction in the total volume of training workloads.

3.) The appearance of new concepts affecting the planning and designing of alternative training periodization.

Origins of the Block Model

The concept of block periodization or the multi-lateral skill development approach was found in the sport schools of the old Eastern Bloc countries, and more recently China (Bompa, 1985; Hartley, 1988; Ho, 1987; Karascony, 1988; Lawerence, 1992; Reilly, 1998). The objective of these schools was to identify, select, and train young athletes with the potential to succeed in regional, national, and international competitions. The thought process was that if children were encouraged to develop a variety of skills they could possibly experience success in several different sporting events. As the young developing athlete showed continued interest, as well as displaying potential, they were nurtured along the path of athletics. By using systematic identification and recruitment, priority was given to the selection of the young athletes thought most likely to benefit from intensive sports training and to produce championship results in world-class competition (Bompa, 2000; Drabik, 1996; Dvorkin, 1992).

The schools' selection was based on the assumption that the requirements for sport mastery can be identified at a young age and subsequently perfected through general training and eventually sport specific training. As the child develops (biologically), their ability becomes much more dynamic. This allows coaches to identify the young athlete's developing traits and place him or her properly within the sport that meets their individual qualifications. Continuous selection, assessment, and evaluation were a continual process, each time resulting in greater refinement of direction for the young athlete. This process was the initial step in the development of the process of Achieving Sports Mastery (PASM) (Siff & Verkhosansky, 1999; Smoll & Smith, 2002). The foundation of the PASM comes from the research of A. Novikov who is considered "the father of Russian physical education," and N.G. Ozolin's research on the concurrent system of training (Novikov, 1949, cited in Siff & Verkoshansky, 1999; Ozolin, 1949, cited in Verkhoshanksy, 1986). This systematic type of training is only valid for athletes of lower qualification and involves the parallel training of several motor abilities, such as strength, speed, and endurance over the same period with the intention of producing comprehensive development of physical fitness (Siff & Verkhosansky, 1999).

Simplified, the concurrent or multi-lateral approach utilizes many different methods and means to develop the young athlete's training level. The rationale behind this system was that if a young athlete developed a well-rounded athletic base rooted in general physical preparation (GPP); his/her overall motor potential would correspondingly rise. Over time, this stimulus would create a response of adaptation, so that the demanding training loads that would eventually occur during specialized physical preparation (SPP) would not stress the body. There is a direct relationship between the

central nervous system (CNS) and physical training. This relationship plays a vital role in the athlete's adaptation to the stimulus because new training loads create new coordination. This neurological super compensation forms the basis for the developing motor skills. As the young athlete matures and attains higher stages in the PASM, the foundation of all subsequent motor systems evolves from the development of GPP, thus the concurrent system (Drabik, 1996).

While the linear model seems well structured, there are several flaws that do exist. For instance, the linear model only allows for the development of any single ability at a time. So, while an athlete is developing muscular endurance, strength and power are sacrificed. When an athlete is undergoing a microcycle focusing on strength or power, an athlete's hypertrophy and endurance are sacrificed.

The block system defines a process where training blocks are sequenced in succession, which ultimately yields a powerful cumulative training effect. Each block emphasizes a primary quality while providing for the maintenance of any secondary, tertiary, etc abilities. Concentrated and distributed loading is unified into the same block. The primary ability is developed through concentrated loading while the rest of the training load is distributed via the abilities, which must be maintained. In other words, while block sequencing does involve the training of all required motor abilities, during any single training block one skill will always comprise the greatest intensive percentage of the training load, while all others are maintained at a secondary capacity (Siff & Verkhosansky, 1999).

The primary differences between the western (linear) model and the block model are as follows:

1.) The block system accounts for retention loads while western/linear periodization does not.

2.) The block system integrates a greater degree of intelligence into the planning and the sequence of blocks in precise order and the planning of blocks vary widely depending on the characteristics of sport form and competition calendars.

3.) The length and duration of the blocks varies from the typical mesocyle associated with western periodization

4.) The block system is multi-dimensional and the classification of each block is planned with precision while the conventional western periodization is very much one dimensional.

5.) There are restrictions created in the linear model by the simultaneous development of a number of motor and technical abilities.

6.) The linear model provides inability for multi-peak preparation.

Block Periodization Concept

In the late 1970's, the concept that was developed from prominent coaches was called training blocks. This idea was open to several different interpretations. In its most comprehensive meaning, training blocks referred to a training cycle of highly concentrated specialized workloads. The use of training blocks as a coaching concept led to several logical consequences (Zatsiosky, 1995):

1.) Highly concentrated training workloads for many qualities cannot be managed at the same time. The training block is an alternative to the widespread practice of simultaneous development of many complex abilities.

2.) Athletic performance in any sport usually demands the mastery of many abilities, which, in the case of training blocks, can only be developed consecutively, not concurrently.
3.) Developing changes that include morphological and biochemical changes require a sufficiently long period of time of about 2-6 weeks, which correspond to the duration of a mesocycle. Thus, training blocks are mostly mesocycle blocks.

The prevailing opinion was that simultaneous development of many abilities was not only inefficient but also led to an excessive training workload. The idea of training blocks was conceptualized and implemented. Three types of mesocycle blocks were created: **accumulation,** which was devoted to developing basic abilities such as general aerobic endurance, muscle strength, and general patterns of movement technique; **transmutation**, which focused on developing specific abilities like combined aerobic-anaerobic or anaerobic endurance, specialized muscular strength, and event-specific technique; and **realization,** which was designed as a pre competitive training phase that focused mainly on competitive model exercises, attaining maximal speed, and recovery prior to the next competition (Zatsiorsky, 1995).

The duration of the blocks was established according to physiological and biochemical prerequisites that usually allowed four weeks for accumulation and transformation mesocycles, and two weeks for realization. These three mesocycles (Table 2) were combined into a separate training stage which ended with competition. A number of training stages formed the annual macrocycle, which was formally subdivided into preparatory and competitive periods. The modified training design allowed for a 10-15% reduction in the annual training volume (Zatsiosky, 1995; Yessis & Trubo, 1987).

Table 2
The Main Characteristics of the Three Types of Mesocycle Blocks

Main Characteristic	Accumulation	Transmutation	Realization
Targets specific motor and technical abilities	Basic abilities; aerobic endurance, muscular strength, basic coordination	Sport-specific abilities, special endurance, strength endurance, proper technique	Integrative preparedness; model performances, maximun speed, event specific tactics
Volume-intensity	High Volume, reduced intensity	Reduced volume, increased intensity	Low-medium volume, high intensity
Fatigue-restoration	Reasonable restoration to provide morphological adaptation	Not possible to provide full restoration, fatigue accumulated	Full restoration, athletes should be well rested
Follow-up	Monitoring the level of basic abilities	Monitoring the level of sport-specific abilities	Monitoring maximum speed, event specific strategy

Another concept affecting the clarification and implementation of the block training approach is the residual training effect. The idea of residual training effect is relatively new to western coaches, but has been used for decades overseas. The residual training effect refers to the retention of changes induced by systematic workloads beyond a certain time period after the cessation of training. This effect is closely connected with detraining, which was previously understood as a loss of trainedness when training was stopped. Detraining in high performance sport usually occurs selectively, according to

specific abilities when not stimulated by sufficient training. For example, maximum oxygen uptake among highly trained endurance athletes decreases when total weekly volume is reduced below a certain level. Similarly, large volumes of highly intense exercises do not prevent detraining and loss of aerobic endurance during the taper (Counsilman & Counsilman, 1991).

When training is designed in the traditional manner and many abilities are developed simultaneously, the risk of detraining is negligible because each quality receives some portion of the training stimuli. However, if these abilities are developed consecutively, as proposed above, the problem of detraining becomes very important. If you develop one ability and lose another one at the same time, you have to take into account the duration of the positive effect of the given training after its cessation and how fast you will lose the obtained ability level when you stop training it. In other words, you need to know the residual effect of each type of training. Table 3 summarizes the duration of the training residuals with regard to different motor abilities.

Table 3. The Duration and Physiological Background of the Residual Training Effects for Different Motor Abilities After Cessation of Training (Counsilman & Counsilman, 1991)

Motor ability	Residual duration, days	Physiological background
Aerobic endurance	30+/- 5	Increased amount of aerobic enzymes, number of mitochondria, glycogen storage and higher rate of fat loss
Maximum strength	30+/- 5	Improvement of neural mechanism and muscle hypertrophy due mainly to musc fiber enlargement

Anaerobic glycolitic endurance	18+/- 4	Increased amount of anaerobic enzymes, higher possibility of lactate accumulation
Strength endurance	15+/- 5	Muscle hypertrophy mainly in slow twitch fibers, better lactic acid tolerance
Maximum speed	5+/- 3	Improved neuro-muscular interactions and motor control, increased phosphocreatine storag

Concentration of training workloads is the most decisive and fundamental principle of the block model. Only highly concentrated training workloads can produce a sufficient stimulus in high level athletes for greater gains in a given motor or technical ability. From this idea the following principles emerge:

1.) Highly concentrated training demands a minimum number of abilities that can be affected simultaneously. The traditional approach is a complex design where many abilities are developed at once.

2.) Consecutive development is the only possible approach when the number of sport-specific abilities needed is more than the number of abilities that can be trained at once.

3.) The mesocycle blocks should be specialized and structured to produce one of three different effects: accumulation (athlete's accumulation the basic abilities); transmutation (athlete's transmutate their motor abilities to event-specific abilities); and realization (athletes realize their preparedness as readiness for competition).

Structuring the Annual Block Cycle

As in the traditional approach, annual cycle planning begins by determining the target competitions. The training program becomes apparent in the subdivision of the annual cycle into a number of training stages, each of which contains three types of mesocycles: accumulation, transmutation, and realization. The sequencing of mesocycles within each training stage makes it possible to carry over optimal residual training effects. Practical implementation of the block model has a number of benefits when compared to the traditional model (Zatsiosky, 1995):

1) The block model allows for a reduction in time expended on training, without changing the total number of workouts.
2) Psychological traits are improved since the athletes can focus on fewer abilities. This allows for more effective maintenance of mental concentration and motivation levels.
3) Nutritional aspects can be more carefully taken into account. A high protein diet can be given to enhance the anabolic effect of strength training while carbohydrates are particularly important in mesocycles for specialized and strength endurance.

There are a number of differences between the traditional and block periodization approaches (Table 4). The dominant principle focuses on the structure of the training workloads, where the use of highly concentrated workloads contrasts with the complex use of various workloads in the traditional approach. The residual training effect concept is part of the scientific background for the block model but plays no part in the traditional model, which was based exclusively on the cumulative training

effect. In addition, development of a wide range of abilities required simultaneous training in the traditional model, but is strictly consecutive in the block structure. The general adaptation of physiological characteristics is very different when the two models are compared. The traditional model exploits mainly adaptation to concurrent stimuli affecting many abilities while the block model assumes superimposition of residual training effects induced by highly concentrated training stimuli administered consecutively (Fox, Bowers & Fosss, 1993; Bompa, 1999).

Table 4. Principle Differences in Training Design Between the Traditional Model and the Block Model

Characteristics of the training design	**Traditional model**	**Block model**
Dominant workload structure	The complex use of different workloads directed at many abilities	The use of highly concentrated workloads directed at a minimum number of abilities
Scientific basis for the planning approach	Cumulative training effect	Cumulative and residual training effects
Sequencing of different abilities	Predominantly simultaneous	Predominantly consecutive
The main planning components	Periods of preparation, preparatory, competitive, and transitory	Preparation includes and combines three types of mesocycle blocks

Participation in competition	Predominantly in the competitive period	Predominantly at the end of each stage
General physiological mechanism involved	Adaptation to concurrent training stimuli affecting many different abilities	Superimposition of residual training effects induced by highly concentrated training stimuli

Recent Studies Supporting the Block Model

A study performed in 2001 using the traditional periodization approach and highly qualified male swimmers during their first eight weeks of early season preparation yielded the following results. The athletes performed a strenuous fitness program combined with extensive swimming, which included resistive exercises and power drills directed to the development of swimming-specific strength and dry-land strength endurance. The fitness program resulted in remarkable improvement in strength endurance, while the swim-specific strength and explosive strength did not improve. During this entire period the swimmers improved their swimming preparedness, evaluated mostly by endurance tests. Therefore, the overall aim of the fitness program was not obtained. Although the swimmers enhanced their strength endurance, they did not improve their maximum swim-specific strength, and their explosive strength decreased. Despite a substantial part of the program devoted to maximal and explosive strength exercises, the expected training effect was dramatically impaired by the negative interaction of the workloads with the strength endurance routines and extensive swimming program (Suslov, 2003).

The following is another example of the problems that exist in the traditional model. Data taken on three world class athletes, Marion Jones, Sergei Bubka, and Stefa Kostadinova show that each had a preseason and in-season preparation lasting about 300-320 days. The time span when these athletes competed and reached peak achievements, and when they had relatively low results varied between 135-265 days. This long time span cannot be subdivided into traditional preparatory and competitive periods. On the other hand, the base abilities of these athletes (maximum strength, capacity of aerobic regeneration) should be maintained on a sufficiently high level during the 5 to 8 month span. Therefore, the appropriate training cycles for basic abilities and recovery should be incorporated into the program. The traditional model does not resolve this problem and is unable to provide such preparation in the basic plan (Suslov, 2003).

An example that supports the block model involves a highly successful, professional soccer player who underwent a one month specialized mesocycle for maximum speed during the off season. The 33 year old soccer player engaged a highly qualified track and field sprint coach who planned, supervised and evaluated his training. The training cycle consisted of individual workouts managed by the coach and partly the athlete. The focused work allowed the athlete to maintain a high level of speed despite the difficulties caused by aging and previous injuries (Issurin, 2007).

In 2006, a group of professional basketball players were studied to look at how program sequencing had an effect on muscle strength and hypertrophy. These athletes performed a large amount of endurance exercises but also needed to maintain their levels of muscle mass and strength. The problem was to find appropriate time for an anabolic strength workout so that it would not interfere with the dominant aerobic work and will

not detract from fine movement technique. It was recommended that the coach planned this workout after the medium load endurance session, and when this was done the coach was quite surprised with the positive results. Another goal of the workouts was to attain muscle hypertrophy, where the crucial factor is not the athlete's state before the workout, but recovery conditions after the workouts in order to provide the anabolic effect. The results were that the sequencing used in the block model was the only reasonable way to achieve all of the desired training goals (Spreuwenberg, Kraemer, & Spiering, 2006)

Summary

The traditional model of training periodization was developed as a universal approach to the planning and preparation of athletes. The tremendous changes in high level sport, as well as the spreading of new training methods, have led to an appearance of new non-traditional coaching concepts. Block periodization, the alternative to the traditional preparation approach, reflects the successful experience of many prominent coaches and the results of long term studies conducted on top-level athletes.

The general idea behind the block model is the use of sequenced specialized mesocycle blocks, where highly concentrated training workloads are focused on a minimal number of motor and technical abilities. Unlike the traditional theory of training periodization that uses simultaneous development of many abilities, the alternative concept provides for consecutive development of the targeted abilities in successive mesocycle blocks. The rationale sequencing of these blocks is based on residual training effects. These training residuals are especially important when athletes improve their abilities consecutively, not concurrently as in the traditional model.

The block periodization concept utilizes mesocycles that consist of three types of specialized blocks: accumulation, for developing basic motor abilities (mostly aerobic, and muscle strength abilities as well as technical skill); transmutation, for developing event specific abilities (mostly anaerobic and more specialized technical skills), and realization, for maximum speed, event specific tactics and full adaptation for competition. These three blocks, taken as a whole, form the training stage.

It should be noted that the traditional approach has visible benefits for the preparation of low and mid-level athletes. The complex organization of workloads directed at many abilities makes training more diversified and attractive. The improvement of lower athletic abilities does not require highly concentrated training workloads because medium level concentration still provides sufficient stimulation. The opposite situation is typical for high-level athletes who need high concentrations of appropriate exercises in order to make progress.

While the overwhelming majority of research and case studies supports the idea that block periodization is superior to traditional linear periodization, the traditional model is still the most commonly used practice in the United States. With more coaches coming forward with information about the block model and how to implement its practice, my hope is that such methods will have more widespread use.

Proposed Curriculum

My curriculum design will consist of a 6-8 week training manual. The manual will be designed to be used for any sport and will serve as development of an athlete's general physical preparedness (GPP). The training manual is intended for coaches and athletes. Coaching requires a special combination of knowledge and experience; my goal

is to show how knowledge implemented in practice can form a new positive experience. The manual is also intended for athletes. Success in athletics takes tremendous effort and dedication. However, the willingness to work harder depends on the athlete's awareness of the aims, means, and methods of their training. My goal is to give athletes a comprehensive explanation of why they must train hard and how to do it wisely.

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CURRICULUM

This is a 6 week GPP (general physical preparedness) program. It is divided into 3 training blocks; each block is 2 weeks long.

Preparation phase 1, anatomical adaptation - early off season

Objectives:

1.) Develop, reestablish, and increase work capacity. Work capacity is the underlying component of any training program. It is the ability to perform work, which determines your level of fitness that in turn will determine your level of preparedness. If you raise your work capacity too fast you will over train and if you reduce it under your current level you will digress. If your work capacity is still at the same level it was two years ago then I will bet you are at the same strength and hypertrophy level you were two years ago.

2.) Reintroduce yourself to the fundamentals of strength development and dynamic functional flexibility.

3.) Start eliminating structural weaknesses developed over the course of a season.

4.) Provide a functional background upon which to commence hypertrophy and strength training.

5.) Using lower intensities will provide a means of active restoration.

6.) Start eliminating unwanted body fat.

Training system:

For the first two training blocks, we will utilize a form of traditional circuit training (TCT) known as mixed circuit training (MCT). This method of combined development

will employ traditional strength training, dynamic flexibility, and cardiovascular training with active rest intervals.

Background information:

1.) Traditional circuit training (TCT) performed with lighter weights (<40% of one's 1RM) and higher repetitions (>20) with no rest intervals, and without aerobic conditioning has been proposed as a highly successful system for developing all around fitness. This is far from accurate as research has shown that TCT by itself is insufficient in developing strength and power and only modest at best in developing local muscular endurance, cardiovascular fitness, and decreases in body fat. Limiting ourselves to just one form of exercise does not allow us to produce simultaneous maximum conditioning of strength, aerobic fitness, and flexibility or mobility.

2.) In actuality, TCT's major limitation is imposed by its very attempt to introduce aerobic conditioning into conventional strength training. The elimination of rest intervals prevents one from using heavier weights and maintaining posture perfect form throughout an exercise. Only when rest intervals are reintroduced into mixed circuit training (MCT) can all around conditioning become possible.

3.) Therefore, the concurrent development of many fitness factors must utilize many different means and methods. Incorporating both weight and endurance training with active rest intervals produces superior results to TCT in terms of improvements in strength and cardiovascular stamina.

4.) Question: some sports are not aerobic so why develop the cardiovascular system? It is true that not all sports are aerobic, but the aerobic pathway plays a vital role in human

performance and is the foundation for all sports, if for no other reason than work capacity, recovery, and overall improvement of the cardio-pulmonary system. Randomized team sports, involving continuous motion performed with varying bursts of power are required to have a properly developed aerobic system. This will allow the team to perform at a maximal intensity in the last half of the game and season.

5.) It is important to realize a new and stable level of general and specific fitness cannot be maintained if restricted to a short time frame. Granted, all necessary abilities can be quickly gained from intensive training, but the resulting positive physiological processes are quickly lost as they were gained. The stability of a high level of fitness is proportionally related to the length of time it took to acquire it. In other words, start preparing for the upcoming season now.

6.) Dynamic flexibility is a must for joint health for all athletes. Movement about a joint creates changes in pressure in the joint capsule that drives nutrients from the synovial fluid (the fluid a joint is encased in) toward the cartilage of the joint. Since cartilage lacks its own blood supply, the chrondrocytes (cells that produce cartilage), must depend on diffusion of oxygen and nutrients from synovial fluid for survival. Appropriately, joint mobility correlates highly with joint health.

The principles of mixed circuit training:

1.) Intensity of exercise

- Strength- training with approximately 50-80% of one's 1RM

- Aerobic- training between 40-60% of one's maximal performance ability over a long distance and 70-80% of one's maximal capability with short, frequent rest intervals.

2.) Density of exercise or work to rest ratio

- Strength- varying from 60s to 3 min
- Aerobic- none at low intensities or 30-90s at higher intensities

3.) Volume of exercise

- Strength- large volume of total weight lifted using a high number of repetitions
- Aerobic- covering longer distances with low intensities or shorter distances at a higher intensity

4.) Physiological effect and training effect

- Strength- muscular endurance, work capacity, muscle cross section area, energy potential, and basic motor coordination
- Aerobic- cardiovascular efficiency, capillarization, oxygen uptake, aerobic capacity, and work capacity

5.) Educational and psychological effect

- Strength and aerobic- determination, foundation of self confidence, physical ability to mobilize oneself to do hard work, and the ability to resist fatigue

Training Instructions for training blocks I & II

1.) General warm up (active, dynamic, and prehabilitation) - make sure that your upper and lower body is thoroughly warmed up before beginning the MCT program. You should be exhibiting a mild to medium sweat throughout the body parts that you are preparing to train.

2.) Upon completion of your warm-up, take a 5 minute break to prepare and set up your exercise stations.

3.) Perform prescribed workout but do not alter the order of the exercises or change exercises within the training block. Prior to starting, make the needed modifications (choice of exercise when an option is given), and then stick with it through the extent of the training block. Not doing so will make it impossible to measure the onset of fatigue and systematic improvement.

4.) As you will notice, these exercises are arranged or paired via lower body and upper body or an agonist (muscle acting) and antagonist (muscle opposing) fashion. Therefore, when one muscle group is working or under contraction its paired or opposing muscle group is relaxing. This acts as a means of active rest.

5.) The same letter followed by an exercise number designates a pair. As an example Al & A2 are trained together, followed by B1 & B2, etc.

6.) Also, when pairing exercises you must complete all sets and reps given for that pair before proceeding to the next pair. For example, complete Al & A2 before moving on to B1 & B2, and so forth.

7.) Consequently, pay attention to the rest intervals. These have been chosen for a specific reason. For example, training block I, exercises Al & A2 with a 2 minute rest interval. Perform a set of A1, rest 2 minutes, perform a set of A2, rest 2 minutes and then repeat for the following sets of those exercises.

8.) The main upper and lower body exercises should be performed unilaterally (single limb) or done with dumbbells. This is to correct any imbalances that have occurred during the season.

9.) It is imperative that you pick a weight that you can handle for all sets designated. Use the highest repetition number for each exercise as the baseline number (even though you might not have to perform that rep scheme on that particular day)

For example: upper body exercise is 2x15

Set 1- perform 15 but could have gotten 19-21

Set 2- perform 15 but could have gotten 17-18

10.) You will perform 3 total body workouts over the period of a week. The training days are varied in intensity. It is imperative that you stick with the weight that you have previously chosen, in the high repetition day, and use the same training weight for the following days. Again, this acts as a means of active rest.

For example:

Db bench press	Monday 2x15	Wed 3x12	Fri 4x8
Weight chosen	Set 1 - 801bs	Set 1 - 801bs	Set 1- 801bs
	Set 2- 801bs	Set 2- 801bs	Set 2- 801bs
		Set 3- 801bs	Set 3- 801bs
			Set 4- 801bs

11.) While you see that the weight remains constant, you must understand that muscles adapt more quickly than tendons and ligaments. Therefore, you must resist the temptation to increase loading on the other 2 training days in the week. You should not be training to failure.

12.) Maintain perfect exercise technique; if you cannot the load is too heavy.

13.) At the conclusion of every strength training session, 20-30 minutes of aerobic conditioning will be performed at a low to medium intensity (heart rate 120-130). This can be done using any piece of cardiovascular training equipment.

14.) Perform a 5-10 minute cool down. This is the appropriate time to perform static stretching.

General warm-up for training blocks I & II

(Active, Dynamic, & Prehabilitation)

*You must warm-up to train not train to warm-up!

I. Active (5-10min) warm-up - utilize any piece of conditioning equipment or jump rope

II. Dynamic warm-up

a. high knee walk

b. elbow to instep w/hamstring

c. lateral lunge

d. sldl

e. squat walk (forward & backward)

f. inchworm

g. spiderman

A-G perform for 10-15 yards each

h. neck flexion and extension x5/5

i. shoulder rolls x5/5 (hands on hips)

j. arm circles x10 (forward & backward)

k. arm swings x20

l. side bends x5/5 (arms straight, hands touch knees)

m. ankle plantar & dorsi flexion x5/5

n. TKE's 2x20

III. Dynamic warm-up hip mobility

a. leg swings x5/5 (side to side)

b. leg swings x5/5 (front to back)

c. quadrupled (all 4's) hip circles x5/5 clockwise & counterclockwise

d. mountain climbers x10

e. hurdle mobility - step over x10 each leg

IV. Prehabilitation

a. Rotator cuff- external/internal rotation 3x15 each

b. Band pull apart 2x20

Training Block III

Training instructions for training block III

1.) In this two week block, you will begin a traditional training template. To the best of your ability, please select the appropriate load with each exercise and keep in mind the set x rep scheme. At this time, underestimating the training load would still be preferred rather than overestimating.

2.) Attention: not all exercises are paired in this training block.

3.) For training block III, the dynamic warm-up has been extended and includes new exercises from the previous two blocks.

4.) During this block, the athletes will also be asked to perform a reasonable amount of aerobic conditioning, preferably on the treadmill. This is more intensive in nature, but still follows the previous guidelines in developing your aerobic system. At this time, miles per hour (mph) are also given. Understand not all athletes are created equal, and prescribe intensity according to your capabilities.

General warm-up for training block III

(Active, Dynamic, & Prehabilitation)

I. Active (5-10min) warm-up - utilize any piece of conditioning equipment or jump rope

II. Dynamic warm-up

a. Neck ext/flexion 5/5

b. Shoulder rolls forward/backward 5/5

c. Arm circles x10/10

d. Side bends x5/5

e. Ankle circles (both directions) x5/5

f. Body weight squats x10

The next series are all performed for 10-15 yards and can be performed forward and backward. Lateral movements are done each way.

g. leg cradle

h. high knee walk

i. elbow to instep w/hamstring

j. lateral lunge

k. squat walk

l. sldl

m. kick through

n. inchworm

o. spiderman

The following series is done for 15-25 yards and can be performed forward and backward. Lateral movements are done each way.

p. high knee skip

q. butt kicks

r. high knee run

s. back peddle

t. lateral bound

u. lateral high knee skip

v. lateral carioca

Hip Mobility

a. Leg swings x5/5 both ways

b. Leg swings x5/5 forward/backward

c. Mountain climbers x10

d. Roll backs into v sits x10

e. Hurdle mobility x10 steps forward and backward

IV. Prehabilitation

a. Rotator cuff- external/internal rotation 3x15 each

b. Band pull apart 2x20

Training Block III Week 1 Monday

* Active Warm up
* Dynamic warm up
* Prehabilitation

Exercise	sets x reps + rest interval (RI) in between pairs	Training weight week 1
A1 Shrugs	2x20 (90s)	
B1 Bench Press	4x6 @ 60% of 1RM (Season Max) (3m)	
C1 Pullups	3x6 (2m)	
D1 Alt Mb Pushups	2x20s(90s)	
D2 Hammer Row	3x10 (90s)	
E1 Db Tri Ext	4x8-10 (90s)	
E2 Db Hammer Curl	4x8-10 (90s)	
F1 Rear Delt Raise	3x15 (1m)	
F2 Russian Twist	3x15 (1m)	

* Aerobic Conditioning 1 minute jogging and 2 minutes recovery walk
  Jog between 6.5 - 9 mph and walk between 2.5 - 3.5 mph and 1-2% grade
  This sequence will be done 5 times for a total of 15 minutes time
* Cool Down